A.Rajshree etal.[5] "a modified sierpinski gasket triangular multiband fractal antenna for cognitive radio". This piece of writing describes about a modified Sierpinski gasket fractal multiband antenna for cognitive radio applications. This proposed new micro strip modified triangular fractal antenna having multiband behaviour in five different resonant frequencies 11.58GHz, 14.15GHz, 20GHz, 30GHz and 35GHz respectively that covers the frequency bands such as X band(8-12GHz), Kuband(12-18GHz), K band(18 - 26.5GHz),Kaband(26.5-40GHz). This antenna had certain advantages like compact (30×30mm) , high directivity(8.15 - 11.86 dBi) and gain(3.2-8.6dBi).And also the analysis was carried out for five different resonant frequencies to synthesize the antenna parameters such as radiation pattern, gain and directivity. The output results prove that this one was well suitable for spectrum sensing in cognitive radio.

B.Taoufik, etal.[6] "Fractal Multiband Planar Antenna for Wireless Power Transmission". In this paper we have developed and designed a low cost fractal Multi band micro strip antenna structure. This antenna was validated in the ISM (Industrial Scientific and Medical) band at 2.45 GHz and 5.8 GHz. The aim of this work is to develop an antenna which can be associated with an RF-DC rectifier to design a rectenna system for wireless power transmission "WPT". The technique used to have a multiband structure is the fractal geometry. The final circuit was a fractal multiband antenna with 65 x 30 mm2 as dimensions.

Ghatak et al. [7] had covered in their paper a second iteration Sierpinski carpet fractal shape UWB antenna with hexagonal boundary. 3 GHz to 12 GHz (VSWR $\leq$ 2) frequency band is covered by this antenna. This antenna had the capability to reject 5.15–5.825 GHz band assigned for IEEE802.11a and HIPERLAN/2 which is attained by inserting a 'Y' shaped slot in the radiator that extends to the central conductor of the CPW feed as well. The simulation and experimental results are very close for the fabricated prototype. Within the band the measured peak antenna gain ranges from 1.25 dBi to 6 dBi . This antenna had a compact size of 33 mm × 32 mm in which we have a substrate around the radiating element. From the time domain characteristic it is revealed that the antenna is non-dispersive having a variation of measured group delay within 0.5 ns over the entire band.

Research Objectives

Objectives of the research paper are being proposed as:

- Design of the Rectangular E shaped fractal microstrip patch antenna**.**
- Simulation of Rectangular E shaped fractal microstrip patch antenna**.**
- Optimization of antenna parameters for larger bandwidth, gain and low return loss.

3. Simulation and Result Analysis

E-Shaped FMPA Design

Antenna corresponding to zeroth iteration is shown in Figure 1(a). First iteration of fractal geometry is applied by cutting two small squares of dimensions 5 mm from square of 20 X 25 mm^2. Feed to antenna is given at point for obtaining better results. Here scale factor is chose to be one fifth. That is entire length is divided into 5 equal parts to make E-shaped antenna. Geometry corresponding to it is shown in Figure 1 (b). To make E-shaped fractal microstrip patch antenna, one has to also apply next iteration of fractal geometry. For it small cuts are made of dimensions 1 mm are removed from square of dimensions 5mm. Geometry corresponding to it is shown in Figure 1(c). From Figure 1 (a), (b) and (c), it is found that self-repeating structures are obtained.

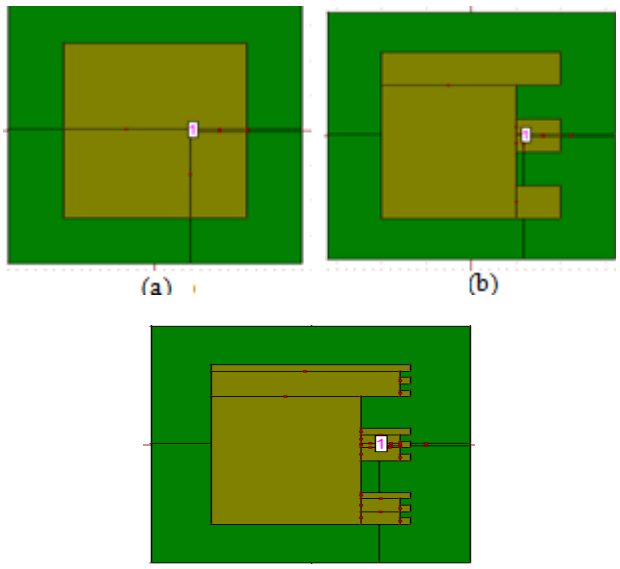

Figure 1: E- Shaped FMPA **(a)** 0th Iteration, **(b)** 1st Iteration and **(c)**2nd Iteration

Feed to antenna is used as coaxial feeding technique we can also use microstrip line feeding technique.

Effect of Changing Feeding Technique

In this research, E-shaped fractal patch antenna has been designed using different feeding techniques:
i). Coaxial feeding technique.
ii). Proximity coupled feeding technique.
Figure 2(a) shows the E-shaped fractal patch antenna that is feed by coaxial feeding. In figure 2(b), proximity coupled feed has been applied on E-shaped fractal patch antenna.

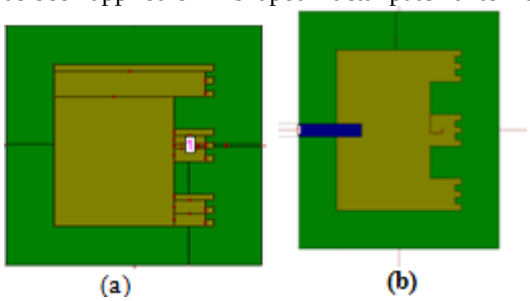

Figure 2: E-shaped fractals patch antenna using (a). Coaxial feeding, , & (b). Proximity coupled feeding.

Proximity coupled feed

In this it has been applied two substrates i.e. substrate 1(lower) & substrate 2(upper). In lower substrate, the dielectric value has greater than the value of upper substrate. In lower substrate FR4 dielectric material has been used. In upper substrate Rogers Dielectric material has been used. In both of substrates, microstrip line has been used. Microstrip

line is between the two substrates so E-shaped fractal patch antenna is physically not connected with the micrpstrip line. This is the basic concept of the proximity coupled feeding technique.

E-shaped Fractal Patch Antenna E-shaped structure as shown in Figure 1 is obtained by applying two iterations on Fractal geometry on rectangular patch having rectangular slot. First two slots are cut so that E-Shape structure is formed. Return loss versus frequency for different iterations are shown in Figure 3. Comparison between two feeding techniques shown in table 1.

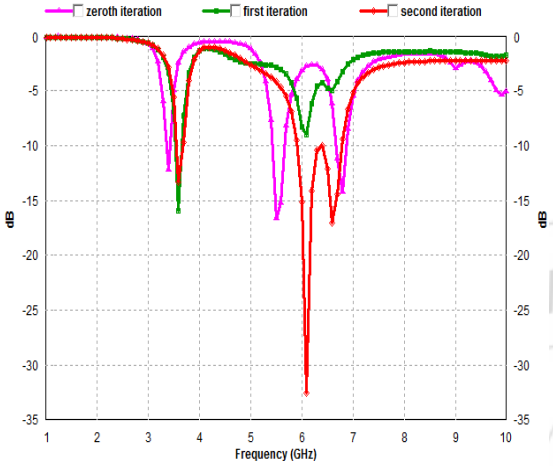

Figure 3: Return Loss Vs. Frequency for Different Fractal Iterationsof E-shaped FMPA

Table 1: Characteristics of Antenna with Different Feeding Techniques.

Feeding Technique used	Resonant Frequency (GHz)	Return Loss (dB)	Gain (dBi)	Bandwidth (MHz)
Using coaxial feed	3.6	-13	3.8	150
	6.1	-33	2.1	850
Using Proximity feed	3.6	-18	3.88	1360
	11.2	-23.6	6.28	1400

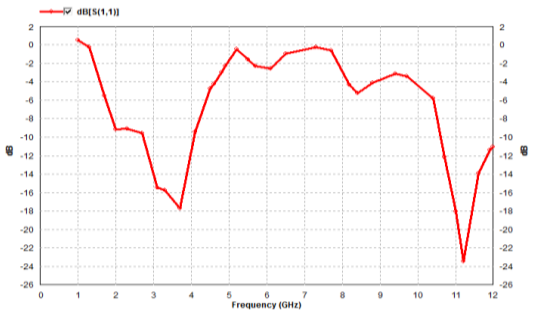

Figure 4: Return loss vs Frequency of Proximity feed

4. Conclusion

Multiband E-shaped fractal antenna is obtained by applying fractal geometry. One of best comparison is made by using comparing results of coaxial feed Design and Proximity coupled feed Design and simulations are carried out using IE3D. E-shaped fractal antenna is obtained by applying Minkowski fractal geometry algorithm. E-shaped fractal patch antenna by applying Proximity coupled technique; antenna resonated at two bands namely 3.6 GHz and 11.2 GHz with return loss of -18 dB and -23.6 dB, gain of 3.88 dBi and 6.28 dBi, directivity of 6.20 dBi and 9.74 dBi. This antenna has bandwidth of 1360 MHz and 1400 MHz at frequency of 3.6 GHz and 11.2 GHz. This antenna has been found best applications for WLAN, Bluetooth, cellular phones, Wi-Fi, Long distance radio telecommunications, Satellite, & Microwave relay and for different S and X bands applications.

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